

WHAT IS CLAIMED IS:

1. A high-frequency signal transmitting device, comprising:

a layered substrate including an uppermost dielectric layer, a bottommost dielectric layer, and a plurality of intermediate dielectric layers located between the uppermost and bottommost dielectric layers;

signal wiring conductors provided between one end and an inner side on the upper surface of the uppermost dielectric layer and between the other end opposite from the one end and the inner side on the lower surface of the bottommost dielectric layer;

grounding conductors provided on the upper surfaces of the respective intermediate dielectric layers and the bottommost dielectric layer and surrounding grounding-conductor non-forming areas of a specified shape provided on the respective dielectric layers;

a signal via conductor vertically penetrating the uppermost dielectric layer and provided within an area facing the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer;

a signal via conductor vertically penetrating the bottommost dielectric layer and provided within an area facing the grounding-conductor non-forming area on the upper surface of the bottommost dielectric layer;

signal via conductors vertically penetrating the respective intermediate dielectric layers and provided within the grounding-conductor non-forming areas of the respective dielectric layers;

signal-wiring connecting conductors provided on the upper surface of the uppermost dielectric layer and on the lower surface of the bottommost dielectric layer and connecting the signal wiring conductors of the uppermost and bottommost dielectric layers with the signal via conductors;

via conductor connecting conductors provided on the upper surfaces of the respective intermediate dielectric layers and the bottommost dielectric layer and connecting the signal via conductors of the respective dielectric layers with those of the dielectric layers right thereabove; and

grounding-conductor via conductors vertically penetrating the respective intermediate dielectric layers and connecting the respective grounding conductors at a plurality of positions around the grounding-conductor non-forming areas of the respective dielectric layers.

2. A high-frequency signal transmitting device according to claim 1, wherein the grounding-conductor non-forming areas of the respective intermediate dielectric layers are concentrically defined along vertical direction, and the signal via conductors of the respective dielectric layers are so

vertically provided along the same axis as to penetrate the centers of the grounding-conductor non-forming areas of the respective intermediate dielectric layers.

3. A high-frequency signal transmitting device according to claim 2, further comprising:

a grounding conductor provided on the upper surface of the uppermost dielectric layer and surrounding the signal wiring conductor of the uppermost dielectric layer with specified gaps defined to the opposite sides of the signal wiring conductor and a grounding-conductor non-forming area defined in the area facing the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer, and

grounding-conductor via conductors vertically penetrating the uppermost dielectric layer and connecting the grounding conductor of the uppermost dielectric layer with the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer at a plurality of positions around the grounding-conductor non-forming area of the uppermost dielectric layer.

4. A high-frequency signal transmitting device according to claim 1, wherein:

the grounding-conductor non-forming areas of the respective intermediate dielectric layers are concentrically

defined along vertical direction;

the signal via conductor of the uppermost dielectric layer is provided at a position near the signal wiring conductor within the area facing the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer;

the signal via conductor of the bottommost dielectric layer is provided at a position near the signal wiring conductor within the area facing the grounding-conductor non-forming area on the upper surface of the bottommost dielectric layer; and

the signal via conductors of the respective intermediate dielectric layers are provided while being displaced by specified distances between the signal via conductors of the uppermost and bottommost dielectric layers.

5. A high-frequency signal transmitting device according to claim 4, wherein the grounding-conductor non-forming areas on the upper surfaces of the middle intermediate dielectric layer and the dielectric layer right therebelow are set to have a smaller area than the grounding-conductor non-forming areas on the upper surfaces of the other dielectric layers.

6. A high-frequency signal transmitting device according to claim 1, wherein:

the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer is provided at a position near the other end distanced from the signal wiring conductor on the upper surface of the uppermost dielectric layer;

the grounding-conductor non-forming area on the upper surface of the bottommost dielectric layer is provided at a position near the one end distanced from the signal wiring conductor on the lower surface of the bottommost dielectric layer;

the grounding-conductor non-forming areas on the upper surfaces of the remaining intermediate dielectric layers are displaced by specified distances between the position near the other end and the position near the one end; and

the signal via conductors of the respective dielectric layers are so vertically provided along the same axis as to penetrate the grounding-conductor non-forming areas of the respective intermediate dielectric layers.

7. A high-frequency signal transmitting device according to claim 1, wherein:

the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer is provided at a position near the other end distanced from the signal wiring conductor on the upper surface of the uppermost

dielectric layer;

the grounding-conductor non-forming area on the upper surface of the bottommost dielectric layer is provided at a position near the one end distanced from the signal wiring conductor on the lower surface of the bottommost dielectric layer;

the grounding-conductor non-forming areas on the upper surface of the remaining intermediate dielectric layers have the positions thereof near the one end successively displaced by specified distances toward the one end from the upper dielectric layers toward the middle dielectric layers with the positions thereof near the other end fixed while having the positions thereof near the other end successively displaced by specified distances toward the other end from the lower dielectric layers toward the middle dielectric layers with the positions thereof near the one end fixed; and

the signal via conductors of the respective dielectric layers are so vertically provided along the same axis as to penetrate the grounding-conductor non-forming areas of the respective intermediate dielectric layers.

8. A high-frequency signal transmitting device according to claim 1, wherein:

the grounding-conductor non-forming areas of the respective intermediate dielectric layers are concentrically

defined along vertical direction;

the grounding-conductor non-forming areas on the upper surfaces of the uppermost intermediate dielectric layer and the bottommost dielectric layer are set to have a smaller area than the grounding-conductor non-forming areas on the upper surface of the other dielectric layers; and

the signal via conductors of the uppermost, bottommost and intermediate dielectric layers are so vertically provided along the same axis as to penetrate the centers of the grounding-conductor non-forming areas of the respective intermediate dielectric layers.

9. A high-frequency signal transmitting device according to claim 1, wherein the length of the signal-wiring connecting conductor on the upper surface of the uppermost dielectric layer between the signal wiring conductor and the signal via conductor is set at a value equal to or smaller than the thickness of the uppermost intermediate dielectric layer in the grounding-conductor non-forming area on the upper surface thereof, and the length of the signal-wiring connecting conductor on the lower surface of the bottommost dielectric layer between the signal wiring conductor and the signal via conductor is set at a value equal to or smaller than the thickness of the bottommost intermediate dielectric layer in the grounding-conductor non-forming area on the upper surface

thereof.

10. A high-frequency signal transmitting device according to claim 1, further comprising:

a grounding conductor provided on the upper surface of the uppermost dielectric layer and surrounding the signal wiring conductor of the uppermost dielectric layer with specified gaps defined to the opposite sides of the signal wiring conductor and a grounding-conductor non-forming area of a specified shape;

a grounding-conductor via conductor vertically penetrating the uppermost dielectric layer and connecting the grounding conductor of the uppermost dielectric layer with the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer at a plurality of positions around the grounding-conductor non-forming area of the uppermost dielectric layer;

a grounding conductor provided on the lower surface of the bottommost dielectric layer and surrounding the signal wiring conductor of the bottommost dielectric layer with specified gaps defined to the opposite sides of the signal wiring conductor and a grounding-conductor non-forming area of a specified shape; and

a grounding-conductor via conductor vertically penetrating the bottommost dielectric layer and connecting the grounding conductor on the lower surface of the bottommost

dielectric layer with the grounding-conductor non-forming area on the upper surface of the bottommost dielectric layer at a plurality of positions around the grounding-conductor non-forming area of the bottommost dielectric layer.

11. A high-frequency signal transmitting device according to claim 10, wherein the grounding-conductor non-forming areas of the uppermost dielectric layer, the bottommost dielectric layer and the respective intermediate dielectric layers are concentrically defined along vertical direction, and the signal via conductors of the respective dielectric layers are so vertically provided along the same axis as to penetrate the centers of the grounding-conductor non-forming areas of the respective intermediate dielectric layers.

12. A high-frequency signal transmitting device according to claim 10, wherein:

the grounding-conductor non-forming areas of the uppermost dielectric layer, the bottommost dielectric layer and the respective intermediate dielectric layers are concentrically defined along vertical direction;

the signal via conductor of the uppermost dielectric layer is provided at a position near the signal wiring conductor within the grounding-conductor non-forming area on the upper surface of the uppermost dielectric layer;

the signal via conductor of the bottommost dielectric layer is provided at a position near the signal wiring conductor within the grounding-conductor non-forming area on the lower surface of the bottommost dielectric layer; and

the signal via conductors of the respective intermediate dielectric layers are provided while being displaced by specified distances between the signal via conductors of the uppermost and bottommost dielectric layers.

13. A high-frequency signal transmitting device according to claim 10, wherein:

the grounding-conductor non-forming areas on the upper surfaces of the uppermost dielectric layer and the uppermost intermediate dielectric layer are provided at the same position near the other end distanced from the signal wiring conductor on the upper surface of the uppermost dielectric layer;

the grounding-conductor non-forming areas on the upper and lower surfaces of the bottommost dielectric layer are provided at the same position near the one end distanced from the signal wiring conductor on the lower surface of the bottommost dielectric layer;

the grounding-conductor non-forming areas on the upper surfaces of the remaining intermediate dielectric layers are displaced by specified distances between the position near the other end and the position near the one end; and

the signal via conductors of the respective dielectric layers are so vertically provided along the same axis as to penetrate the grounding-conductor non-forming areas of the respective dielectric layers.

14. A high-frequency signal transmitting device according to claim 10, wherein:

the grounding-conductor non-forming areas on the upper surfaces of the uppermost dielectric layer and the uppermost intermediate dielectric layer are provided at the same position near the other end distanced from the signal wiring conductor on the upper surface of the uppermost dielectric layer;

the grounding-conductor non-forming areas on the upper and lower surfaces of the bottommost dielectric layer are provided at the same position near the one end distanced from the signal wiring conductor on the lower surface of the bottommost dielectric layer;

the grounding-conductor non-forming areas on the upper surface of the remaining intermediate dielectric layers have the positions thereof near the one end successively displaced by specified distances toward the one end from the upper dielectric layers toward the middle dielectric layers with the positions thereof near the other end fixed while having the positions thereof near the other end successively displaced by specified distances toward the other end from the lower dielectric layers

toward the middle dielectric layers with the positions thereof near the one end fixed; and

the signal via conductors of the respective dielectric layers are so vertically provided along the same axis as to penetrate the grounding-conductor non-forming areas of the respective intermediate dielectric layers.

15. A high-frequency signal transmitting device according to claim 10, wherein:

the grounding-conductor non-forming areas on the upper surface of the uppermost dielectric layer, on the lower surface of the bottommost dielectric layer and on the upper surfaces of the respective intermediate dielectric layers are concentrically defined along vertical direction;

the grounding-conductor non-forming areas on the upper surfaces of the uppermost intermediate dielectric layer, on the lower surface of the bottommost dielectric layer, on the upper surfaces of the uppermost intermediate dielectric layer and the bottommost dielectric layer are set to have a smaller area than the grounding-conductor non-forming areas on the upper surface of the other dielectric layers; and

the signal via conductors of the uppermost dielectric layer, the bottommost dielectric layer and the respective intermediate dielectric layers are so vertically provided along the same axis as to penetrate the centers of the grounding-

conductor non-forming areas of the respective intermediate dielectric layers.

16. A high-frequency signal transmitting device according to claim 10, wherein the length of the signal-wiring connecting conductor on the upper surface of the uppermost dielectric layer between the signal wiring conductor and the signal via conductor is set at a value equal to or smaller than the thickness of the uppermost intermediate dielectric layer in the grounding-conductor non-forming area on the upper surface thereof, and the length of the signal-wiring connecting conductor on the lower surface of the bottommost dielectric layer between the signal wiring conductor and the signal via conductor is set at a value equal to or smaller than the thickness of the bottommost dielectric layer in the grounding-conductor non-forming area on the upper surface thereof.

17. A high-frequency signal transmitting device according to claim 1, further comprising:

a frame provided on the upper surface of the layered substrate for accommodating a semiconductor device; and

a lid provided on the upper surface of the frame accommodating the semiconductor device.

18. A high-frequency signal transmitting device

according to claim 17, further comprising:

a grounding conductor provided on the upper surface of the uppermost dielectric layer and surrounding the signal wiring conductor of the uppermost dielectric layer with specified gaps defined to the opposite sides of the signal wiring conductor and a grounding-conductor non-forming area of a specified shape;

a grounding-conductor via conductor vertically penetrating the uppermost dielectric layer and connecting the grounding conductor of the uppermost dielectric layer with the grounding-conductor non-forming area on the upper surface of the uppermost intermediate dielectric layer at a plurality of positions around the grounding-conductor non-forming area of the uppermost dielectric layer;

a grounding conductor provided on the lower surface of the bottommost dielectric layer and surrounding the signal wiring conductor of the bottommost dielectric layer with specified gaps defined to the opposite sides of the signal wiring conductor and a grounding-conductor non-forming area of a specified shape; and

a grounding-conductor via conductor vertically penetrating the bottommost dielectric layer and connecting the grounding conductor on the lower surface of the bottommost dielectric layer with the grounding-conductor non-forming area on the upper surface of the bottommost dielectric layer at a plurality of positions around the grounding-conductor non-

forming area of the bottommost dielectric layer.